(12) UK Patent Application (19) GB (11) 2 327 066 (13) A

(43) Date of A Publication 13.01.1999

(21) Application No 9714460.4

(22) Date of Filing 09.07.1997

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(51) INT CL^6
B60R 21/22

(52) UK CL (Edition O)
B7B BSB

(56) Documents Cited
US 5588672 A

(58) Field of Search
UK CL (Edition O) **B7B BSB**
INT CL^6 **B60R 21/16 21/22**
Online: WPI

(54) Abstract Title
Improvements in or relating to an air-bag

(57) An air-bag for a motor vehicle, comprising an inflatable element(1) adapted to be mounted in position in or adjacent the roof of the vehicle extending along the side of the vehicle so that the inflatable element, when inflated, forms a curtain located between the occupant of the vehicle and the side of the vehicle, the inflatable element comprising a gas duct(2) extending axially of the element and a plurality of inflatable cells(4) extending transversely of the element, part of the inflatable element being formed by two intersecting chambers(12,13) which communicate with the gas flow duct which are of a substantially "X" configuration extending substantially from the gas flow duct to the lower edge of the inflatable element. The chambers(12,13) serve the function of applying tension to the lower edge of the inflatable element(1) as it is inflated.

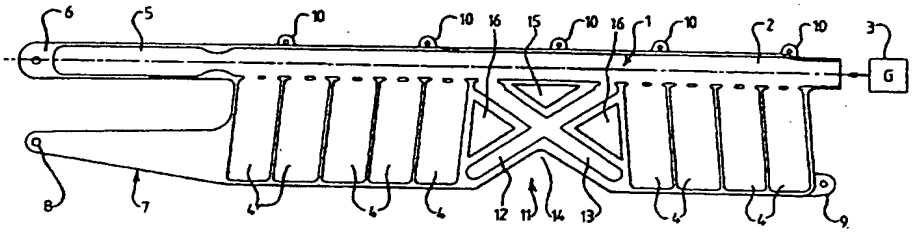

FIG 1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

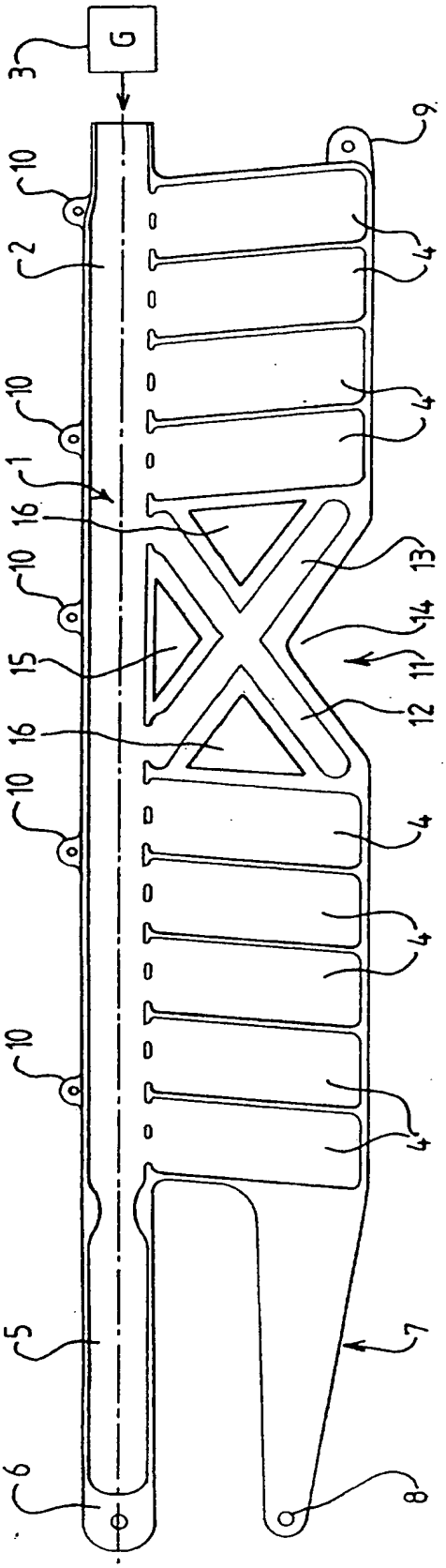

FIG 1

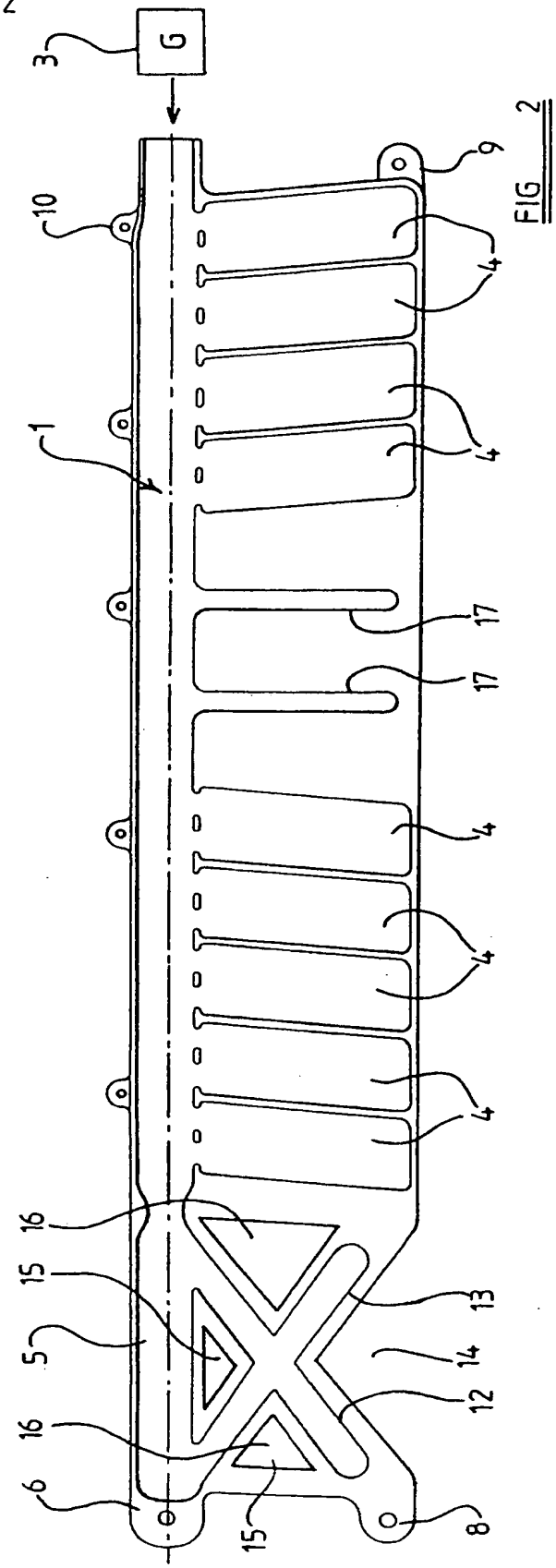

FIG 2

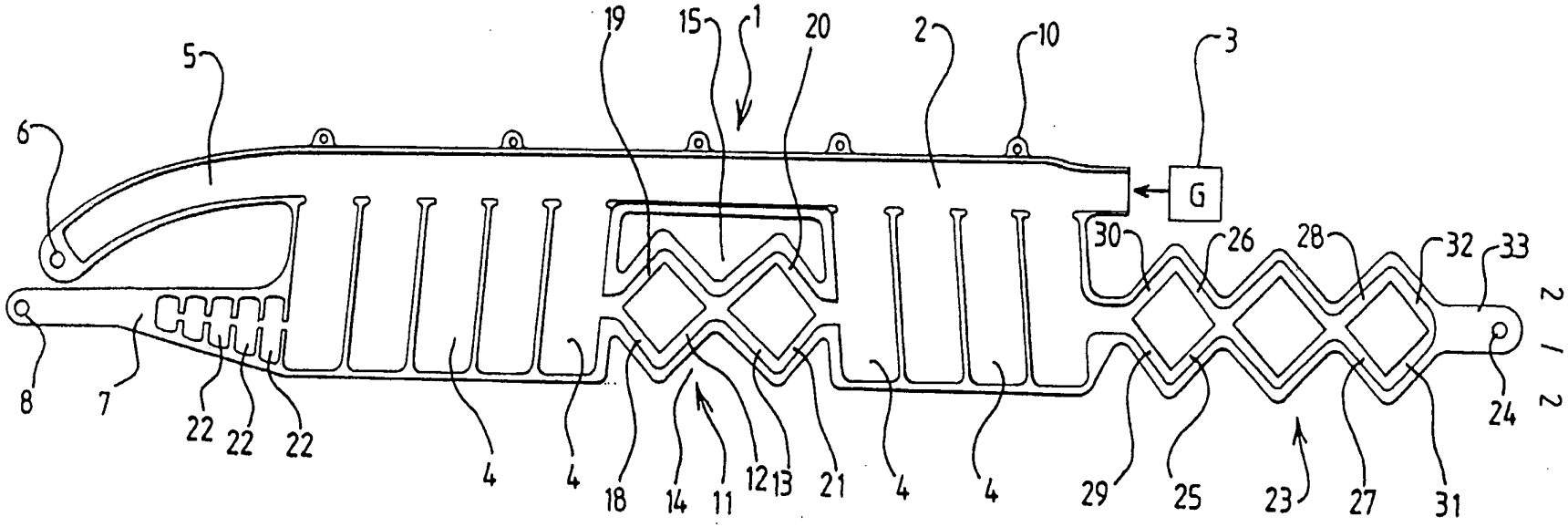
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FIG 3

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PATENTS ACT 1977

P11432GB-NHF/vt

"Improvements in or relating to an air-bag"

THIS INVENTION relates to an air-bag, and more particularly relates to an air-bag arrangement in a motor vehicle such as a motor car.

It is known to provide air-bags in motor vehicles, such as motor cars, which air-bags are adapted to inflate in the event that an accident should arise, to provide protection for an occupant of the vehicle.

It has been proposed to provide an air-bag which, when inflated, is located between the head and upper thorax of an occupant of the vehicle and the roof frame, and at least the "A" and "B"-Post and the door, together with a window present in the door of the vehicle. The air-bag may also extend adjacent the side of the vehicle by the rear seat to the "C"-Post or "D"-Post. The purpose of such an air-bag is to prevent the head of an occupant of the vehicle hitting the window or the posts, or other parts of the structure of the vehicle, and also to prevent the head of the occupant from emerging through the window opening if the window should be broken, or in the lowered position. An air-bag of this type may be termed an inflatable curtain.

If the air-bag is to perform the desired function of retaining the head of the occupant in the vehicle when the window has been broken, an event which frequently arises during a side impact, or if the window is open, then the air-bag must have sufficient rigidity so that the air-bag is not itself forced out of a broken or open window. A particular problem arises in ensuring that a lower edge of such an air-bag is sufficiently rigid to prevent the

air-bag being pushed out through a window by the occupant during an accident.

It is to be appreciated that an air-bag of this type may be initially mounted in position in a motor vehicle in a non-linear housing or recess. The housing or recess may extend along the roof frame contour. Fixing points for the air-bag may be provided at opposed ends of the non-linear housing or recess, and the arrangement may be such that when the air-bag is inflated, the lower edge of the air-bag is to extend tightly in a linear fashion between these two fixing points. Thus, the air-bag must be longer, in the uninflated state, than the linear distance between the fixing points, since the distance within the housing or recess, along the roof contour, is longer than the straight-line distance between the fixing points. However, the air-bag must be designed so that the lower edge becomes tight and substantially rigid on inflation of the air-bag.

It is to be understood that an air-bag of this type must be inflated very swiftly, since the air-bag is intended to provide protection in the event of a side impact or roll-over. Inflation times of 10mS or less are appropriate and consequently it is desirable that the bag should be inflated by a minimum volume of gas. The greater the volume of gas which is needed to inflate the bag, the longer will be the inflation time, since the gas has to be moved physically from the gas generator to all the interior parts of the bag that expand as the bag is inflated.

The present invention seeks to provide an air-bag adapted to be readily stored in a non-linear housing or recess, but which can be inflated rapidly, using a minimum

quantity of gas, with the lower edge of the air-bag then being substantially rigid when the bag is inflated.

According to this invention, there is provided an air-bag for a motor vehicle, comprising an inflatable element adapted to be mounted in position in or adjacent the roof of the vehicle extending along the side of the vehicle so that the inflatable element, when inflated, forms a curtain located between the occupant of the vehicle and the side of the vehicle, the inflatable element comprising a gas duct extending axially of the element and a plurality of inflatable cells extending transversely of the element, part of the inflatable element being formed by two intersecting chambers which communicate with the gas flow duct and which are of a substantially "X" configuration extending adjacent the lower edge of the inflatable element or an extension thereof, material between the intersecting chambers at the lower edge being cut-away.

Preferably, the intersecting chambers are provided at a central region within the inflatable element.

Advantageously the intersecting chambers are formed in a strap forming an extension extending from the main part of the inflatable element to a fixing eye.

Conveniently the air-bag is made of two superimposed layers, the superimposed layers of fabric being interconnected by a one-piece weaving technique with the threads from the upper layer of fabric being interwoven with threads from the lower layer of fabric in selected regions to form seams that interconnect the upper and lower layers of fabric.

Advantageously part of the fabric between the upper parts of the intersecting chamber is cut-away.

Conveniently part of the fabric on opposed sides of the intersecting chambers is cut-away.

The invention also relates to a motor vehicle provided with an air-bag arrangement, the air-bag arrangement comprising an air-bag as described above together with a gas generator adapted to inflate the air-bag.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a sectional side view of one embodiment of the invention when the air-bag is in a flat and unpacked state,

FIGURE 2 is a corresponding sectional side view of an alternative embodiment of the invention, and

FIGURE 3 is a further corresponding sectional side view of another alternative embodiment of the invention.

An air-bag arrangement embodying the present invention is intended to provide protection for a person sitting in a seat in a motor vehicle. It is envisaged that the invention will provide the greatest benefits in cars like multi-purpose vehicles or vans, or vehicles like mini-buses which have deep roof contours and low fixing points.

In any accident in which the vehicle is decelerated the driver or front-seat passenger will tend to move forwardly towards the steering wheel or dashboard, but will be restrained by a conventional seat belt or air-bag. In the case of a side impact or roll-over, there is a risk that the head or upper thorax of the driver or occupant will strike the adjacent window in the door, or strike the B-post, or the roof frame. There is also a risk that if, as most commonly happens, the glass in the window should break, the head of the person may be thrown out of the window, especially in the case of roll-over. A similar problem will be experienced by a rear seat passenger.

The air-bag arrangement comprises a gas generator which is adapted to generate gas, such as cold gas. The gas generator incorporates, or is associated with, a sensor which senses a side impact and/or a roll-over situation to activate the gas generator at an appropriate instant. The gas generator is connected, to an inflatable element. The inflatable element may be made of interwoven fabric, using a one-piece weaving technique. Thus the element maybe made of two super-imposed layers of fabric, with threads from the warp and weft of the upper layer being inter-woven with threads forming the warp and weft of the lower layer in selected regions to form seams that interconnect the upper and lower layers of fabric.

Referring to Figure 1, in which the air-bag arrangement is shown in a flat and uninflated state, the inflatable element 1 comprises a linear, substantially horizontally extending gas duct 2, having one open end to which a gas generator 3 is to be connected. The gas duct 2 extends axially of the inflatable element. A plurality of parallel, substantially vertical, cells 4 are located beneath the gas duct 2. The cells 4 extend transversely of

the inflatable element. The upper part of each cell 4 communicates, by means of an opening, with the duct 2, so that gas flowing through the duct 2 will inflate the cells 4.

The inflatable element is provided with means to mount the inflatable element in position. At the end of the gas duct 2 remote from the open end, there is an extension 5 of the inflatable duct that terminates with a fixing eye 6. Beneath the extension 5 of the duct 2, there is a fixation strap 7 extending from the lower-most edge of the part of the inflatable element defining the parallel cells 4, the strap 7 also terminating with a fixing eye 8. A further fixing eye 9 may be provided at the lower-most edge of the cell 4 closest to the open end of the gas duct 2 and further fixing eyes 10 may be provided at spaced positions along the gas duct 2. The inflatable element may be mounted in position by means of the fixing eyes. The fixing eyes will be secured to anchoring points provided on the body shell of the vehicle.

A central region of the inflatable element 11 is not provided with parallel cells 4, but instead is provided with two intersecting linear chambers 12,13 which intersect to form a "X", each chamber communicating, by means of an opening, with the gas flow duct 2. The chambers extend substantially from the gas duct 2 to the opposed, lower, edge of the inflatable element. At least a portion of the fabric forming inflatable element is cut-away in the area 14 defined between the intersecting chambers 12,13. A portion of the fabric may also be cut-away in the area 15 defined between the upper ends of the chambers, with further portions of fabric being cut-away in the areas 16 on either side of the intersecting chambers 12,13.

The inflatable element 1, when folded as described, may be mounted in a non-linear recess extending over the door frame and part-way down at least the "A"-Post of the motor vehicle, the recess optionally extending to the "C"-Post or "D"-Post, depending upon the nature of the vehicle in which the inflatable element is mounted. The inflatable element would normally be retained within the recess by means of a cover or the like.

When the inflatable element 1 is in the stored position the chambers 12,13 extend substantially parallel with each other.

In the event that an accident should occur, the gas generator 3 would inflate the inflatable element. The inflatable element would emerge from the housing and form an inflated curtain located between the occupants of the vehicle and the doors and windows provided at the side of the vehicle.

During inflation of the inflatable element, gas would flow through the gas duct 2 and into the cells 4. On entering the cells 4, the gas would cause the fabric forming the opposed side walls of the cells to bulge outwardly, as the cells assume a cylindrical form, and this deformation of the fabric would cause the effect of shortening the lower edge of the inflatable element. The gas would also inflate the intersecting chambers 12,13. The inflation of the chambers 12,13 would cause an effective axial shortening of the lower edge of the curtain, as the chambers 12,13 deploy from the stored condition, in which the chambers are parallel with each other, to an "X" configuration when the chambers are inflated. Thus the chambers 12,13 would serve to apply a

tension to the lower edge of the inflatable element as shown in Figure 1.

The combined effect of the shortening of the lower edge of the inflatable element by the expansion of the cylindrical cells and the effect of the inflation of the intersecting chambers 12,13 applies a tension to the lower edge of the inflatable element so that it becomes tensioned and substantially rigid.

It is to be appreciated that the region 14 of the inflatable element where the intersecting chambers are provided may be selected to be located immediately behind the "B"-Post of the motor vehicle so that inflated cells 4 are located adjacent the "B"-Post to prevent the head of an occupant inadvertently striking the "B"-Post. There is only a minimal risk of the head of an occupant striking the side of the vehicle at a position immediately behind the "B"-Post of the vehicle. The cells 12,13, together with the cells 4, will provide a substantial tensioning effect on the lower edge of the inflatable element. The cells 12.13 are only of a relatively low volume, consequently requiring a minimum volume of gas to secure their inflation.

Figure 2 illustrates a modified embodiment of the invention. A large proportion of the features of this embodiment are the same as those described with reference to Figure 1 and are identified by the same reference numerals and will not be re-described in detail here.

It is to be noted that in the embodiment of Figure 2, the intersecting chambers 12,13 are no longer located at a central position, but instead are located at one end of the inflatable element, between the end of the inflatable

elements 4 and the fixing eyes 6,8. The central region of the inflatable element is provided with two relatively narrow inflatable ribs 17, although it is to be appreciated that in a further modified embodiment the central region could be provided with a second set of intersecting chambers 12,13.

Figure 3 illustrates another embodiment of the invention where a substantial proportion of the features are as described with reference to Figure 1. Again these features will be identified with the same reference numerals, and will not be redescribed in detail.

In the central region 14 of the inflatable element 1 shown in Figure 3, a pair of intersecting chambers 12,13 are provided. However, the left-hand ends of the chambers 12,13 are connected to the adjacent inflatable cylindrical cell 4 by ducts 18,19 respectively, which extend to a single point on the wall of the cell 4, thus forming, with the left-hand ends of the chambers 12,13 a diamond shape. Equivalent ducts 20,21 connect the right-hand ends of the chambers 12,13 to a single point on the adjacent cylindrical cell 4. Material below the combination of the chambers 12,13 and the associated ducts 19-21, is cut-away in the region 14, and is also cut-away above the combination of chambers and ducts in the region 15.

The strap 7, shown at the right-hand side of Figure 3 is provided with a plurality of cells 22, which are interconnected and which are adapted to inflate on inflation of the inflatable element 1. The effect of inflation of these cells is to shorten the effective length of the strap 7.

At the right-hand side of Figure 3 a fixing strap 23 is illustrated, which extends from the lower edge of the cell 4 on the right-hand side of the inflatable element to a fixing eye 24. The strap comprises two interconnected pairs of intersecting chambers 25,26 and 27,28. The left-hand ends of the chambers 25,26 are connected to the right hand cell of the inflatable element 1 by ducts 29,30 respectively, and the right-hand ends of the chambers 27,28 are interconnected by ducts 31,32 respectively, the ducts 31,32 communicating with each other adjacent the end of a tab 33 that forms the terminal part of the strap 23 carrying the fixing eye 24. The fabric below and above the combination of the chambers and ducts that makes up the strap 23 as described above is cut-away.

When the strap is in the initial folded condition the intersecting chambers and the ducts that make up the strap will lie parallel with each other and the strap will have a corresponding length. On inflation of the inflatable element the chambers and ducts will inflate, and will occupy the position shown in Figure 3. When the strap is in this condition it will have a substantially shorter length, thus applying tension to the lower edge of the inflatable element.

The invention provides an inflatable element that can be stored within a non-linear recess or housing that extends, for example, along the roof line of a motor vehicle above the door (and window) openings in the side of the vehicle. The opposed ends of the recess or housing will be located at positions below the central part of the recess. The inflatable element, on inflation, will emerge from the recess or housing and comprise a substantially rigid curtain, with the lower edge extending directly

between the opposed ends of the recess or housing, and with the upper part of the inflatable element secured to the recess or housing. The curtain is intended to provide protection for occupants of a vehicle in a side impact or roll-over situation, and thus the inflatable element may be inflated in response to a signal from a sensor adapted to sense such situations.

CLAIMS:

1. An air-bag for a motor vehicle, comprising an inflatable element adapted to be mounted in position in or adjacent the roof of the vehicle extending along the side of the vehicle so that the inflatable element, when inflated, forms a curtain located between the occupant of the vehicle and the side of the vehicle, the inflatable element comprising a gas duct extending axially of the element and a plurality of inflatable cells extending transversely of the element, part of the inflatable element being formed by two intersecting chambers which communicate with the gas flow duct and which are of a substantially "X" configuration extending adjacent the lower edge of the inflatable element or an extension thereof, material between the intersecting chambers at the lower edge being cut away.

2. An air-bag according to Claim 1, wherein the intersecting chambers are provided at a central region within the inflatable element.

3. An air-bag according to Claim 1, wherein the intersecting chambers are located adjacent one end of the inflatable element.

4. An air-bag according to any one of the preceding Claims wherein the intersecting chambers are formed in a strap forming an extension extending from the main part of the inflatable element to a fixing eye.

5. An air-bag according to any one of the preceding Claims, wherein the air-bag is made of two superimposed layers, the superimposed layers of fabric being interconnected by a one-piece weaving technique with the

threads from the upper layer of fabric being interwoven with threads from the lower layer of fabric in selected regions to form seams that interconnect the upper and lower layers of fabric.

6. An air-bag according to any one of the preceding claims wherein part of the fabric between the upper parts of the intersecting chambers is cut-away.

7. An air-bag according to any one of the preceding Claims wherein part of the fabric on opposed sides of the intersecting chambers is cut away.

8. A motor vehicle provided with an air-bag arrangement, the air-bag arrangement comprising an air-bag according to any one of the preceding claims and a gas generator adapted to inflate the air-bag.

9. An air-bag substantially as hereinbefore described with reference to and as shown in Figure 1 of the accompanying drawings.

10. An air-bag substantially as hereinbefore described with reference to and as shown in Figure 2 of the accompanying drawings.

11. An air-bag substantially as hereinbefore described with reference to and as shown in Figure 3 of the accompanying drawings.

12. Any novel feature or combination of features disclosed herein.

The Patent Office

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Application No: GB 9714460.4
Claims searched: 1 to 8

Examiner: Karl Whitfield
Date of search: 26 September 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7B (BSB)

Int Cl (Ed.6): B60R 21/16, 21/22

Other: Online database: Derwent World Patents Index accessed via Questel

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5588672 (KARLOW et al.) especially figure 5	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.